

CLAIMS

What is claimed is:

1. A method of developing a selectively irradiated photoresist material layer disposed on a semiconductor wafer comprising:
contacting the photoresist material layer with a volume of developer having a concentration for a period of time whereby the developer and an acid in the photoresist material layer interact to generate an amount of water;
measuring the amount of water;
determining an amount of acid consumption based on the amount of water measured; and
adjusting at least one of the volume of developer, the concentration of developer and the period of contact time based on the amount of acid consumption determined.
2. The method of claim 1, wherein the step of adjusting includes adjusting the volume of developer.
3. The method of claim 1, wherein the step of adjusting includes adjusting the concentration of developer.
4. The method of claim 1, wherein the step of adjusting includes adjusting the period of contact time.
5. The method of claim 1, wherein the step of adjusting includes adjusting the volume of developer, the concentration of developer and the period of contact time.
6. A system of monitoring development of a selectively irradiated photoresist material layer comprising:

at least one light source disposed near the selectively irradiated photoresist material layer, the at least one light source adapted to transmit a ray of light across the selectively irradiated photoresist material layer;

at least one detector disposed near the selectively irradiated photoresist material layer, the at least one detector adapted to receive a reflected ray of light due to the at least one light source and provide a signal corresponding to the intensity of the reflected ray of light;

a measuring system operably coupled to the at least one detector, the measuring system adapted to receive the signal corresponding to the intensity of the ray of light and convert the signal to digital data; and

a processor operatively coupled to the measuring system, the processor adapted to receive the digital data from the measuring system and analyze the digital data wherein the difference of the intensity of the ray of light from the at least one light source to when it is received by at least one detector is proportional to an amount of water generated across the selectively irradiated photoresist material layer due to an interaction of a developer and an acid in the selectively irradiated photoresist material layer.

7. The system of claim 6, wherein the measuring system applies in-situ laser scattering.

8. The system of claim 6, wherein the measuring system applies laser doppler anemometry.

9. The system of claim 6, wherein the measurement system applies interferometry.

10. The system of claim 6, wherein the measuring system applies spectrometry.

11. The system of claim 6, wherein the processor outputs the analyzed data to a display.

12. The system of claim 6, wherein the at least one light source includes a first light source directed at a first area of the selectively irradiated photoresist material layer and a second light source directed at a second area of the selectively irradiated photoresist material layer and the at least one detector includes a first detector disposed at a location adapted to receive reflected light from the selectively irradiated photoresist material layer due to the first light source and a second detector disposed at a location adapted to receive reflected light from the selectively irradiated photoresist material layer due to the second light source.

13. A system of controlling development of a selectively irradiated photoresist material layer comprising:

a nozzle adapted to contact the selectively irradiated photoresist material layer with a volume of developer having a concentration for a period of time;

a measuring system adapted to measure an amount of water generated on the selectively irradiated photoresist material layer due to an interaction of the developer and an acid in the selectively irradiated photoresist material layer; and

a processor operatively coupled to the measuring system and a developer volume and concentration control system, the processor receiving data from the measuring system relating to the amount of water measured and the processor using the data to determine acid consumption of the selectively irradiated photoresist material layer, the processor being further adapted to provide adjustment information to the developer volume and concentration control system for adjusting at least one of the volume of developer, the concentration of developer and the period of contact time, so that a subsequent selectively irradiated photoresist material layer having a more uniform development can be achieved.

14. The system of claim 13, wherein the measuring system is one of an in-situ laser scattering system, a laser doppler anemometry system, an interferometry system and a spectrometry system.

15. The system of claim 13, wherein the developer is a mixture of concentrated developer and water.

16. The system of claim 15, wherein the developer volume and concentration control system adjusts the concentration of the developer by varying an amount of concentrated developer and water in the mixture.

17. The system of claim 16, wherein an electronically controlled valve controls the flow of at least one of the concentrated developer and water that flows into a mixing chamber, wherein the concentrated developer and water mixture is formed.

18. The system of claim 17, wherein the electronically controlled valve and the mixing chamber are disposed inside the nozzle.

19. A system of developing a selectively irradiated photoresist material layer disposed on a semiconductor wafer comprising:

means for contacting the selectively irradiated photoresist material layer with a volume of developer having a concentration for a period of time whereby the developer and an acid in the photoresist material layer interact to generate an amount of water;

means for measuring the amount of water; and

means for determining an amount of acid consumption based on the amount of water measured.

20. The system of claim 19, further including means for adjusting the concentration of the developer based on the determined acid consumption.

21. The system of claim 19, further including means for adjusting the volume of developer based on the determined acid consumption.

22. The system of claim 19, further including means for adjusting the contact time.
23. The system of claim 20, further including means for controlling the means for applying a developer.